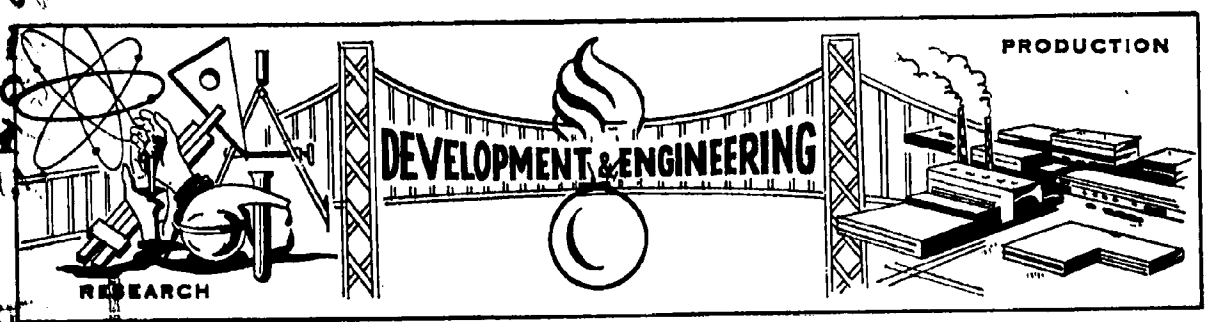

TECHNICAL REPORT
DC-TR: 1-4-62

EVALUATION
OF
MASK, ANTIFLASH, ROCKET LAUNCHER, M19A1

BY
ELBERT HUSELTON
PAUL SCHINDLER

COPY NO. 27 OF 33

MARCH 1962

AMMUNITION GROUP
PICATINNY ARSENAL - DOVER, NEW JERSEY

TECHNICAL REPORT

EVALUATION OF MASK, ANTIFLASH, ROCKET LAUNCHER, M19A1

BY

ELBERT HUSELTON

PAUL SCHINDLER

Report No. DC-TR: 1-4-62

SUBMITTED BY: _____
F. SEDLACEK
Chief, Maintenance
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H. RUTKOVSKY
Chief, Ammunition
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D. KATZ
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J. J. MATT
Chief, Ammunition
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Engineering Division

SF

TABLE OF CONTENTS

SECTION I

INTRODUCTION

Various malfunctions were reported in 1959 and early 1960 in which firing of the 3.5 Inch Rocket, M28A2 and M29A2, resulted in excessive blowback. In all these malfunctions (MIFs A-110-59, A-1-60, A-124-60, A-188-60), personnel received cuts, burns or abrasions from blowback of unburned propellant particles in the rocket exhaust -- in some instances even when they were wearing the Mask, Antiflash, Rocket Launcher, M19.

In 1960 these malfunctions, in addition to earlier reported incidents of the same nature, resulted in a series of test firings at Aberdeen Proving Ground in which rockets were investigated for blowback and for adequacy of protection furnished by the M19 Antiflash Mask. The findings showed blowback to be prevalent at all low temperature firings, with both penetration and lens breakage occurring in the M19 Antiflash Mask. Based on this, the weapon was restricted from use at temperatures below freezing (32°F.) pending redesign of the M19 Antiflash Mask.

In January 1961, a firing program was conducted by Picatinny Arsenal (Reference 1) to: 1) determine whether this excessive blowback was due to degradation of the rocket motors in storage 2) measure the variation of blowback with temperature 3) determine whether the Mask, Protective, Field, M9A1 (Gas Mask) furnished adequate protection as an interim measure pending development and prove-out of an improved rocket anti-flash face mask. Results of this study indicated that: 1) blowback on firing 3.5 inch rockets at temperatures less than 70°F. was inherent in

the design and did not reflect an aging problem 2) the 3.5 Inch Rocket was satisfactory for firing at all temperatures to -20°F., provided adequate face and eye protection was worn 3) Mask, Protective, Field, M9A1 was entirely satisfactory for repeatedly withstanding blowback from rounds conditioned for maximum blowback (-20°F.).

Based on these tests, the Ordnance Ammunition Command lifted the 32°F. temperature restriction on all M28 and M29 Series Rockets by world-wide teletype February 1961. Instructions were issued that: 1) eye protection in the form of goggles or similar equipment was mandatory for operating personnel when firing 3.5 inch rockets at temperatures of 70°F. and above 2) face and hand protection was necessary at all temperatures below 70°F. 3) Mask, Protective, Field, M9A1, was prescribed for face protection 4) other types of face protection were no longer authorized.

In June 1961, 20 M19A1 Antiflash Masks were shipped to Picatinny Arsenal for simulated service tests with cold-conditioned rounds of 3.5 Inch Rockets and for general comment relative to adequacy of the mask for the intended use (Appendix C). The purpose of the test program covered by this report, therefore, was to evaluate the adequacy of the M19A1 Antiflash Mask, developed by the Chemical Corps Engineering Command as a replacement for the M19 Antiflash Mask.

A summary of the test results was forwarded to the Chemical Corps on 6 Sept 1961.

SECTION II

SUMMARY

Two series of 3.5 Inch Rocket firings at -20°F. were run to observe the effect of rocket blowback on the M19A1 Antiflash Mask.

In the first series -- consisting of 20 firings. -- the mask was mounted six inches aft of the launcher bell-mouth. In the second series -- consisting of 18 firings -- the mask was mounted in a position corresponding to the gunner's head.

The firings showed that the M19A1 Antiflash Mask did provide adequate protection against 3.5 Inch Rocket blowback. The M19 Antiflash Mask, tested in the first series for comparison purposes, was badly damaged.

Study of the new (M19A1) mask indicated need for human engineering.

SECTION III

CONCLUSIONS

The Mask, Antiflash, Rocket Launcher, M19A1 provides adequate protection against 3.5 Inch Rocket blowback, but design of the mask is not optimum from a human engineering standpoint.

SECTION IV

RECOMMENDATIONS

1. Consideration to be given design modifications including:

    a. Permanently fastening the eyepiece to the mask portion.

    b. Providing more effective shielding at the sides of the eyepiece.

2. Other human engineering factors, such as those affecting aim or comfort be evaluated.

3. After completion of human engineering, the Mask, Antiflash, Rocket Launcher, M19A1 be worn when firing M28 and M29 Rocket series at all temperatures below 70°F.

4. Eye protection in the form of goggles or similar equipment be worn when firing 3.5 Inch Rockets at temperatures of 70°F. and above.

ACTION TAKEN

The results of this evaluation, along with recommendations for human engineering, were forwarded to the Chemical Corps 6 September 1961 (Reference 2).

SECTION V

STUDY

Two series of 20 flight firings at -20°F. were made to evaluate the effect of 3.5 Inch Rocket blowback on the Mask, Antiflash, Rocket Launcher, M19A1.

In the first series, a rectangular board, with a hole cut out of the center for the launcher, was positioned perpendicular to the launcher axis at a distance six inches aft of the launcher muzzle. The board surface was covered with a four-inch thick layer of foam rubber. One M19A1 Antiflash Mask and one M19 Antiflash Mask (used for comparison purposes) were mounted on the board (Figure 1). Blowback witness sheets, to provide semi-quantitative measurements of the extent of blowback, were mounted on the other side of the launcher. At five-round intervals, the positions of the masks were reversed to minimize the effect of mask position as a variable (Figures 2-4).

The standards used in grading blowback witness sheets (Figures 5a-5e) are:

Blowback	Description
0	No penetration
1	Very lightly peppered
2	Lightly peppered
3	Moderately peppered
4	Heavily peppered
5	Severely peppered

The results of these firings are summarized in Table 1. The average blowback ranking of 4.5 showed that the test lot of rockets produced a relatively large amount of unburned propellant and, therefore, provided a good test of mask effectiveness.

As seen from Figure 6 and 7, the face covering of the M19 Mask was severely punctured. Also, one of the lens sustained a crack about 3/8" long. The M19A1 Mask, however, suffered only four pinhole penetrations; three in the leather eyepiece support, and one in the lower part of the mask (Figure 8). One of the eyepieces had several shallow chips, but there was no cracking of the lens.

In the second series, only the M19A1 Mask was tested. The mask was mounted in a position corresponding to the gunner's head (Figure 9) and was not moved until the firings were completed. After 18 firings, no penetration of the mask or eyepiece was observed (Table II). Only a very few particles were found imbedded in the mask (Figure 10).

Based on these results, it was concluded that the M19A1 Antiflash Mask provides adequate face and eye protection when firing 3.5 Inch Rockets at -20°F., the low temperature firing limit for the 3.5 Inch Rocket and the condition in which the degree of blowback is most severe.

Although the materials used in the M19A1 Mask successfully resisted propellant blowback, it was considered that the design of the mask was not optimum from a human engineering standpoint because (1) the operator could inadvertently neglect to fasten all the snaps holding the eyepiece to the face portion (2) the screen on the side of the eyepiece could allow penetration of propellant particles if the mask was not properly worn or the head was turned to one side as the rocket was fired.

It was recommended, that consideration be given to modifying the design before issuance to the field including:

1) Permanently fastening the eyepiece to the mask portion.

2) Providing more effective shielding at the sides of the eyepiece.

REFERENCES

1. E. Huselton, D. Eleasier and S. Kaplowitz, Evaluation of Blowback in the 3.5 Inch Rocket; M28A2, Picatinny Arsenal Technical Report No. DB-TR: 4-61, dated June 1961.

2. Letter to Commanding Officer, U. S. Chemical Corps Engineering Command, Army Chemical Center, Maryland from Commanding Officer, Picatinny Arsenal on evaluation of Mask, Antiflash, Rocket Launcher, M19 (Improved Type), dated 30 June 61. (Complete text in Appendix C.)

APPENDICES

APPENDIX A

TABLES

Table I Series I

Results of Series I Firings at -20°F to Evaluate M19A1 Antiflash Mask

Rd No.	Velocity Ft/Sec	Blowback Ranking	Remarks
1	318	5	Position of masks shown in Figure 1
2	312	5	
3	315	5	
4	319	4	
5	311	4	Masks after firing of Round 5 shown in Figure 2
6	317	5	
7	318	4	
8	316	4	
9	313	5	
10	311	5	Masks after firing of Round 10 shown in Figure 3
11	309	5	
12	312	5	
13	320	5	
14	311	5	
15	310	4	Masks after firing of Round 15 shown in Figure 4
16	317	4	
17	321	4	
18	318	3	
19	310	5	
20	311	5	
Avg.	313	4.5	

Table II

Results of Series II Firings at -20°F to Evaluate M19A1 Antiflash Mask

Rd No.	Velocity Ft/Sec	Remarks
1	317	Firing Set-up Shown in Figure 9.
2	319	Firing Set-up Shown in Figure 9.
3	314	Firing Set-up Shown in Figure 9.
4	315	Firing Set-up Shown in Figure 9.
5	314	Firing Set-up Shown in Figure 9.
6	316	Firing Set-up Shown in Figure 9.
7	322	Firing Set-up Shown in Figure 9.
8	318	Firing Set-up Shown in Figure 9.
9	313	Firing Set-up Shown in Figure 9.
10	317	Firing Set-up Shown in Figure 9.
11	315	Firing Set-up Shown in Figure 9.
12	316	Firing Set-up Shown in Figure 9.
13	310	Firing Set-up Shown in Figure 9.
14	321	Firing Set-up Shown in Figure 9.
15	320	Firing Set-up Shown in Figure 9.
16	312	Firing Set-up Shown in Figure 9.
17	307	Firing Set-up Shown in Figure 9.
18	320	Firing Set-up Shown in Figure 9.
Avg.	316	

APPENDIX B

FIGURES

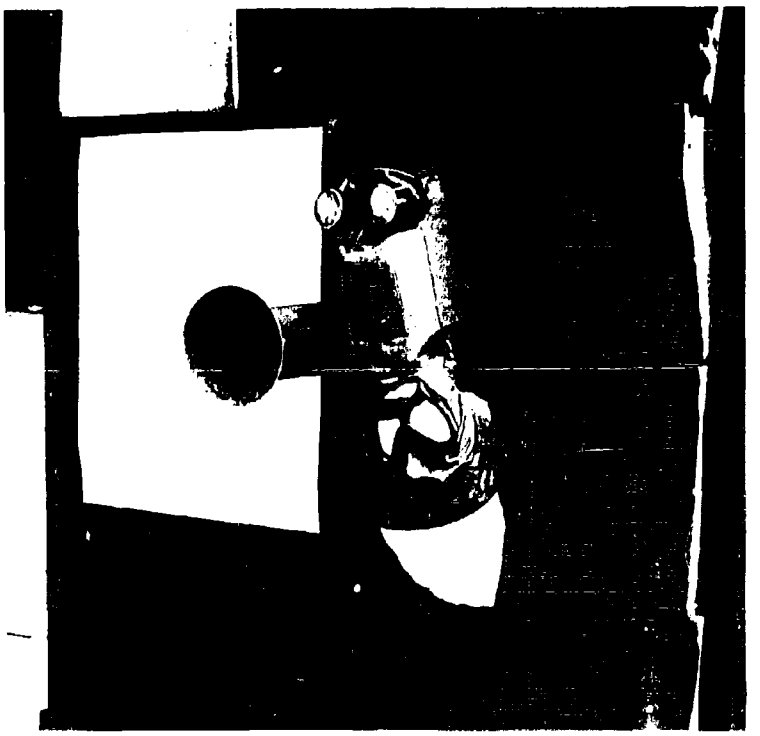

Figure 1. Test Set Up for Series I Firings

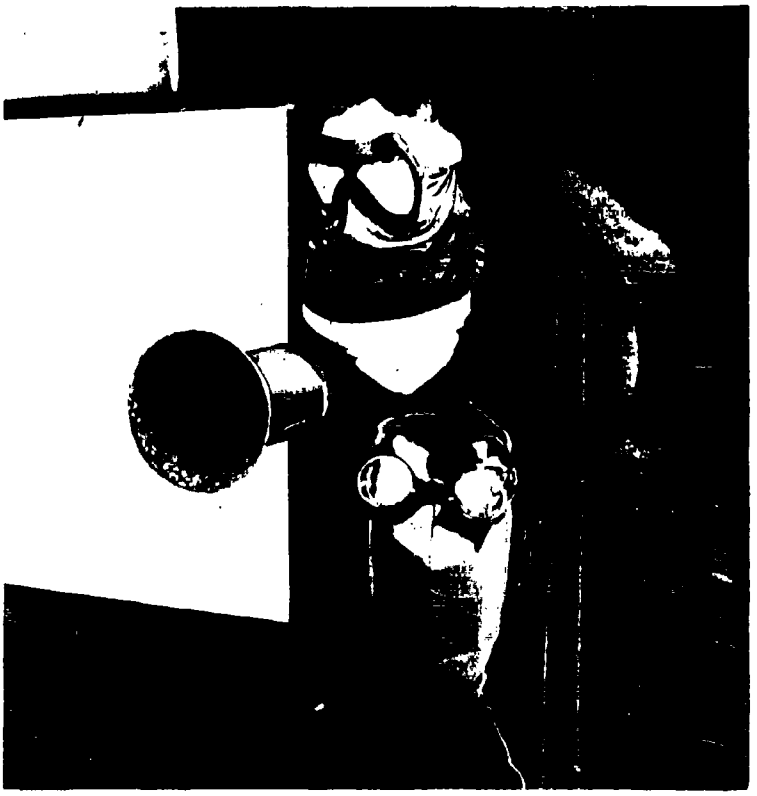

Figure 2. Masks After Firing of Round 5, Series I

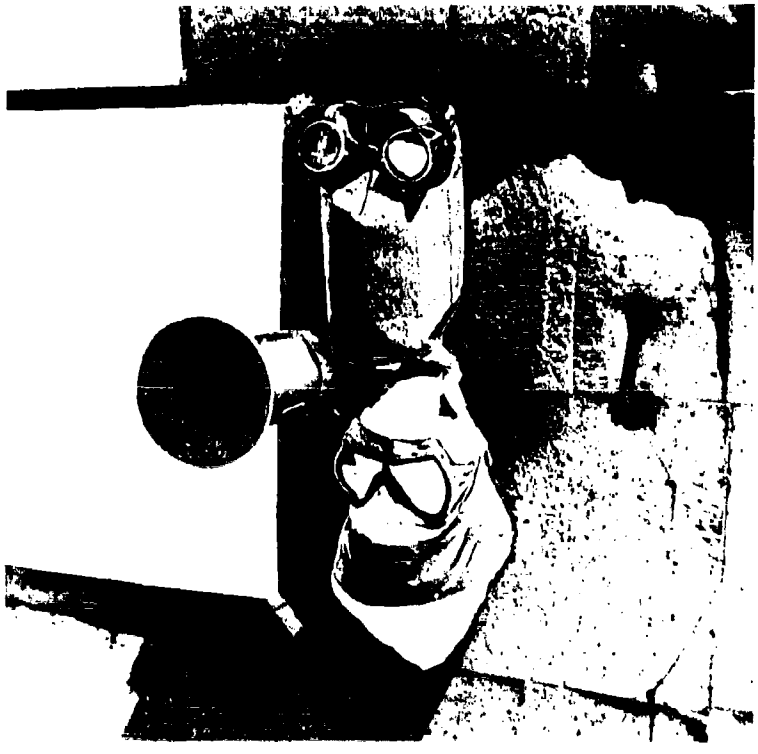

Figure 3. Masks After Firing of Round 10, Series I

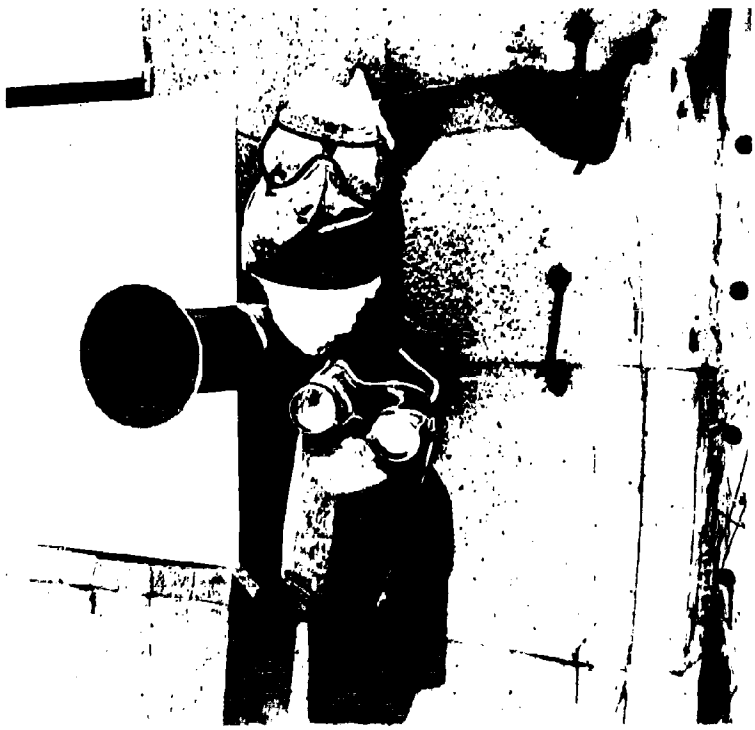

Figure 4. Masks After Firing of Round 15, Series I

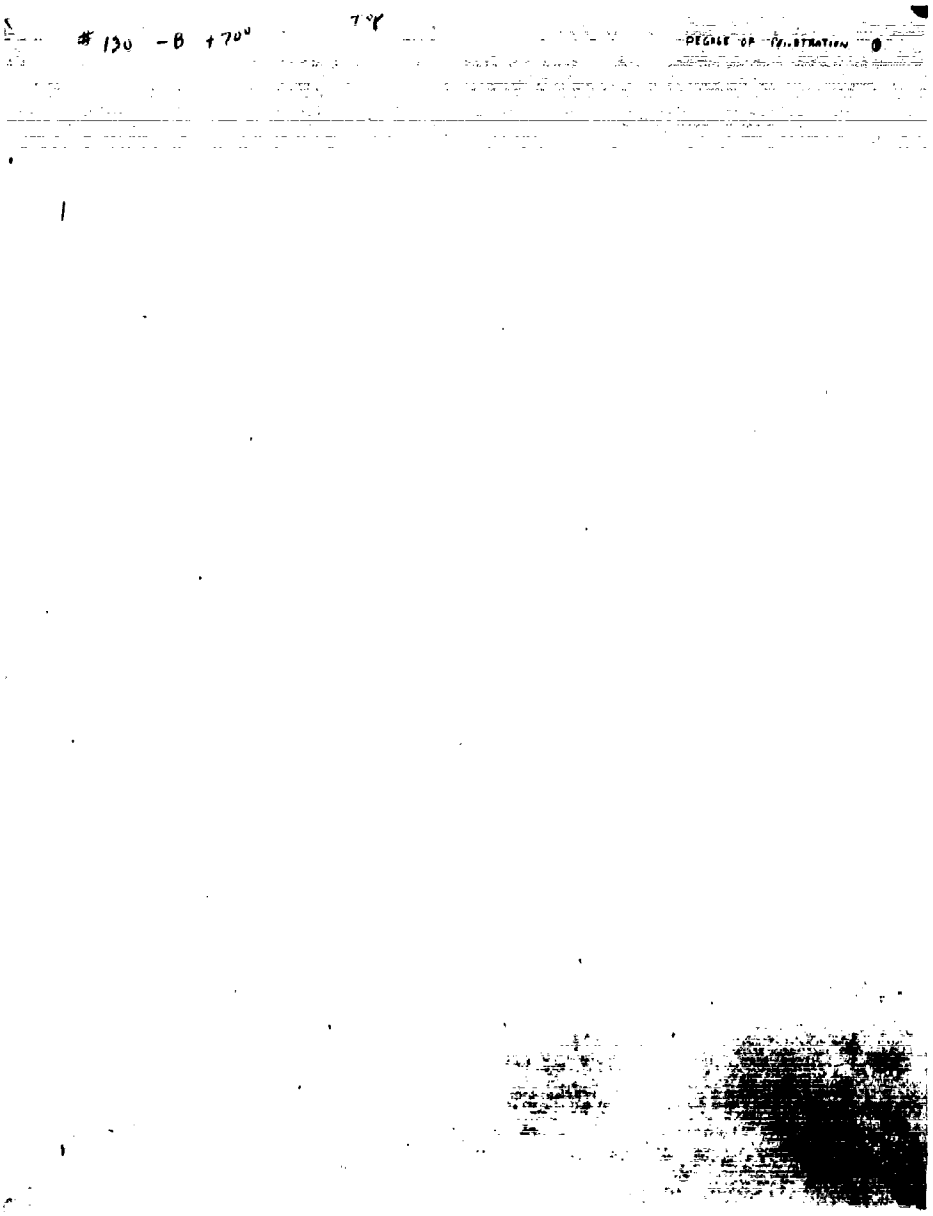

Figure 5A. Typical Witness Sheet for Degree of Penetration #1 Very Lightly Peppered

Figure 5B. Typical Witness Sheet for Degree of Penetration #2, Lightly Peppered

Figure 5C. Typical Witness Sheet for Degree of Penetration #3, Moderately Peppered

Figure 5D. Typical Witness Sheet for Degree of Penetration #4, Heavily Peppered

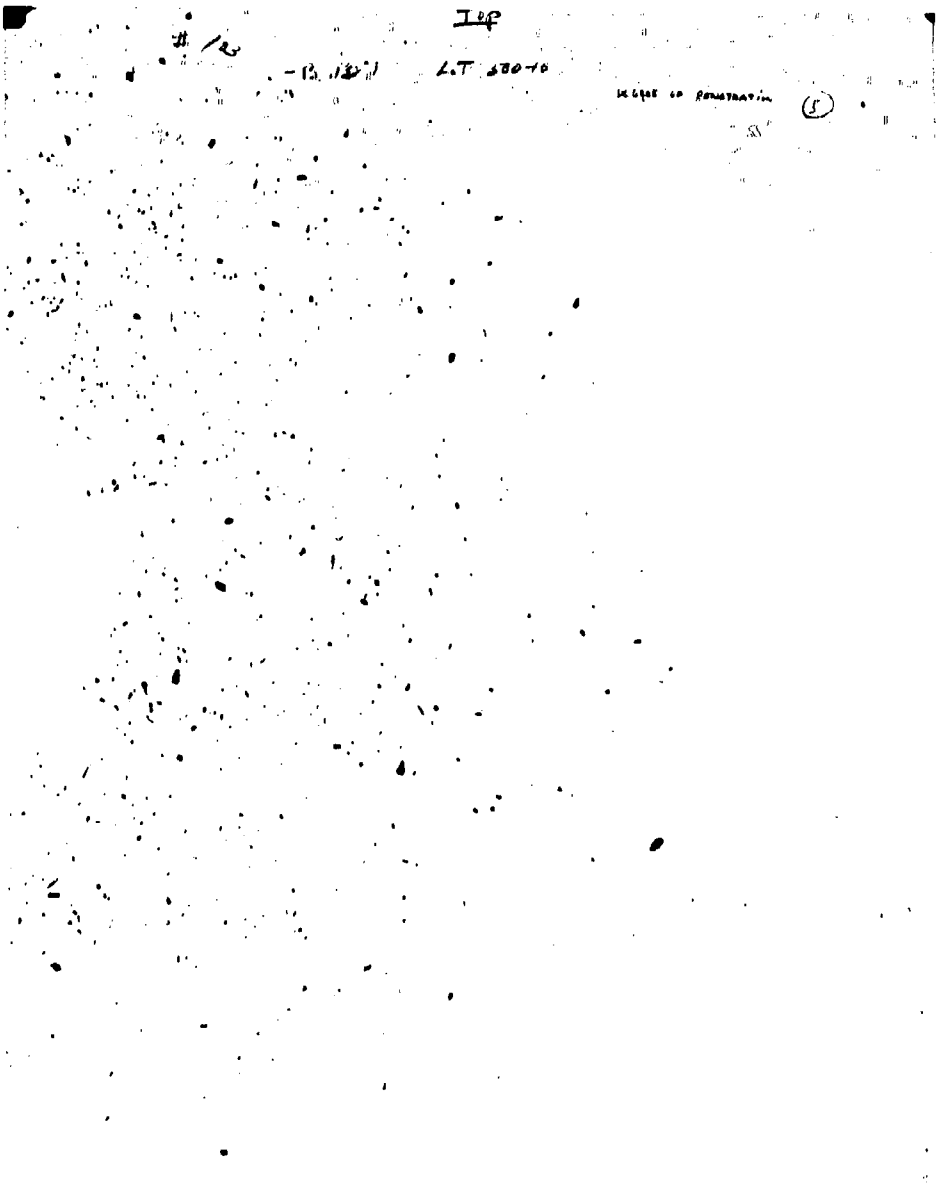

Figure 5E. Typical Witness Sheet for Degree of Penetration #5, Severely Peppered

Figure 6. M19 Mask After Exposure to 20 Firings, Series I

Figure 7. M19 Mask Showing Cracked Left Lens After Exposure to 20 Firings, Series I

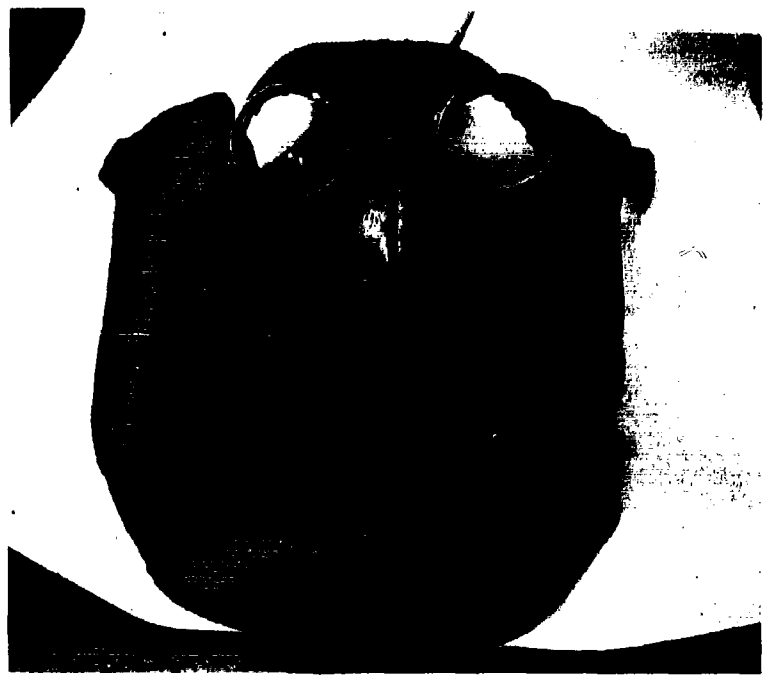

Figure 8. M19A1 Mask After Exposure to 20 Firings, Series I

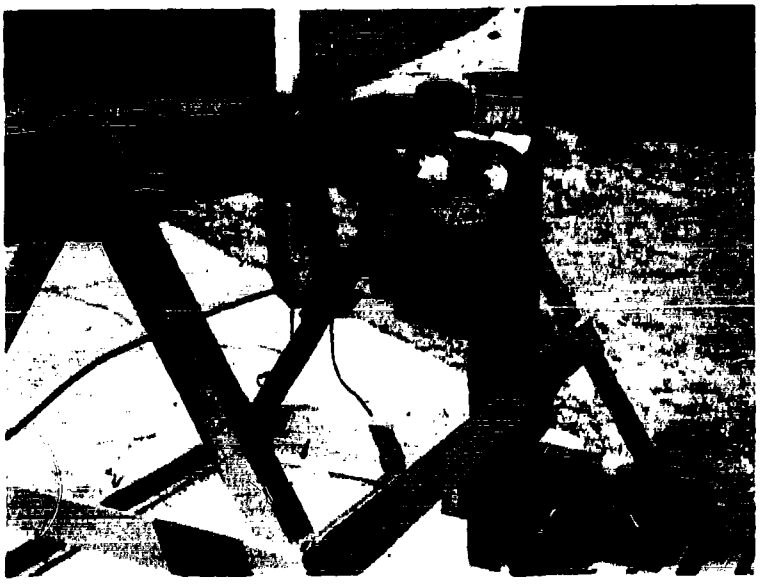

Figure 9. Test Set Up for Firing of Rounds 1-18, Series II

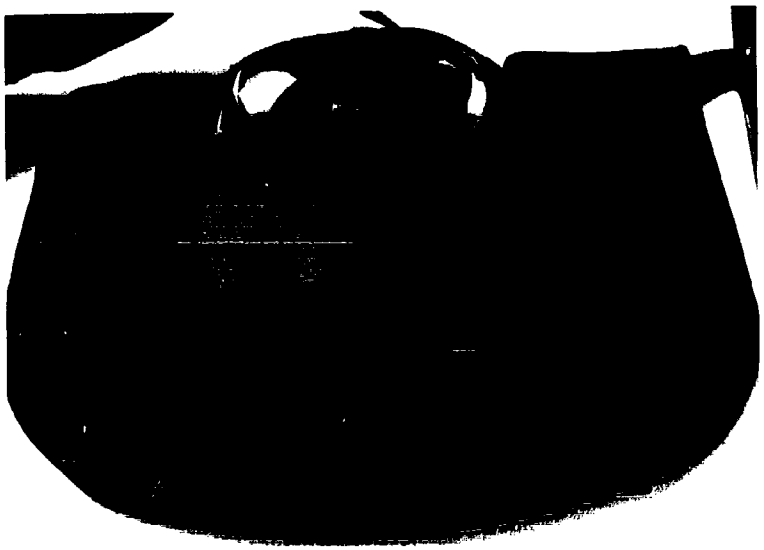

Figure 10. M19A1 Mask After Exposure to 18 Rounds in the Position of the Gunner's Head, Series II

APPENDIX C

LETTERS

HEADQUARTERS
U.S. ARMY CHEMICAL CORPS ENGINEERING COMMAND
ARMY CHEMICAL CENTER, MARYLAND

IN REPLY REFER TO:
CMLEN-WSP 30 June 1961

SUBJECT: Mask, Antiflash, Rocket Launcher, M19 (Improved Type)

TO: Commanding Officer
ATTN: ORDBB-DC5
Picatinny Arsenal
Dover, New Jersey

COPY

1. Development and widespread use of the 2.6 in. Rocket (bazooka) during World War II resulted in a requirement for a mask to protect the eyes and face of the operators during firing operations. The item developed to meet this need was the Mask, Face, Launcher, Rocket, classified as a standard type by OMTC Item No. 13-44, 28 July 1944. This mask consisted of M-1943 Goggles to which thin rubberized fabric skirtings were sewed. Subsequent to World War II, this mask was made obsolete by the Quartermaster Corps.

2. With the advent of the 3.5 in. Rocket Launcher, U.S. Continental Army Command (USCONARC) confirmed that a requirement existed for a mask to protect the gunner's face and eyes. It had been noted that during firing operations particles of propellant and occasionally an arming wire back flashed, impacted on and sometimes pierced the skin of the gunner. It was further noted that cold weather increased the quantity of this firing debris with which the gunner had to contend.

3. The Mask, Face, Launcher, Rocket, was not considered by USCONARC to be the optimum item to meet requirements of the 3.5 in. Rocket Launcher gunner but was considered usable and an item of issue until a more suitable replacement could be produced. The mask was recaptured from obsolescence and became a gained item of the Chemical Corps. It was type classified as a Standard B Item, Mask, Antiflash, Rocket Launcher, M19, by CCTC Item No. 3634 approved 29 September 1959. It became an item of issue pending availability of an improved type.

CMLEN-WSP 30 June 1961
SUBJECT: Mask, Antiflash, Rocket Launcher, M19 (Improved Type)

4. Test run in July 1960 at Aberdeen Proving Ground showed that the M19 Mask was frail and not adequate for the intended use. The Chemical Corps then recommended that the Mask, Protective, Field, M9A1, be used in place of the M19 as an interim measure pending availability of an improved M19.

5. In accordance with discussions with your Messrs. Schaffer and Kester, 16 June 1961, 20 improved M19 Masks were shipped to Picatinny Arsenal 20 June 1961 for simulated service test with cold conditioned round of 3.5 in. rockets and general comment relative to adequacy of the mask for the intended use. Further work toward type classification of the item will be dependent upon results of these tests.

6. Results of tests and comments are requested.

FOR THE COMMANDER:

MAX KERSCHENSTEINER
Chief, Product Engineering Division
Dir/Weapons Systems Engineering

Cpy furnished:
Lt Col R. J. Phillips,
USCONARC Ln Off

REFERENCE 2

ORDBB-DC5 (30 Jun 61) 1st Ind Mr RSchindler/pjb/5135
SUBJECT: Mask, Antiflash, Rocket Launcher,M19 (Improved Type)

Ordnance Corps, Picatinny Arsenal, Dover New Jersey

TO: Commanding Officer, U.S. Army Chemical Corps Engineering Command
ATTN: OMLEN-WSP, Army Chemical Center, Maryland

1. Evaluation of the adequacy of the subject mask to provide protection against unburned propellant and other debris in firing the 3.5 inch rocket at low temperatures has been completed by this Arsenal. Two series of rocket firings were made at -20°F. In the first series, which consisted of 20 firings, the mask was mounted six inches aft of the launcher bell-mouth; in the position of the gunner's head. The firings showed that the M19A1 Mask did provide adequate protection against blowback, while the M19 Mask, tested in the first series of firings for comparison data, was badly damaged.

2. Although the materials used in the M19A1 Mask successfully resisted propellant blowback, it is considered that the design of the mask is not optimum from a human engineering standpoint; i.e., (1) the operator could inadvertently neglect to fasten all the snaps holding the eyepiece to the face portion, (2) the screen on the side of the eyepiece could allow penetration of propellant particles if the mask is not properly worn or the head is turned to one side as the rocket is fired. It is recommended, therefore, that consideration be given to modifying the design before issuance to the field, including the following:

a. Permanently fastening the eyepiece to the mask portion.

b. Providing more effective shielding at the sides of the eyepiece.

3. Other human engineering factors, such as those affecting aim or comfort, have not been evaluated. It is assumed that these factors will be considered before issuance of the mask.

4. A complete report of the above tests and recommendations will be published and forwarded to your Command by 1 January 1962.

FOR THE COMMANDER:

CC:
OSWAC, ORDSW-A
CONARC Liason Officer (Lt Col Boisvert)

COPY

ABSTRACT DATA

ABSTRACT

AD _____ Accession No. _____

Picatinny Arsenal, Ammunition Group
Dover, New Jersey

EVALUATION OF MASK, ANTIFLASH, ROCKET LAUNCHER, M19A1.

Elbert Huselton and Paul Schindler.

Technical Report DC-TR: 1-4-62, March 1962.
11 pp, photographs, tables.
Unclassified Report.

Two series of 3.5 Inch Rocket firings at -20°F were run to observe the effect of rocket blowback on the M19A1 Antiflash Mask.

In the first series -- consisting of 20 firings -- the mask was mounted six inches aft of the launcher bell-mouth. In the second series -- consisting of 18 firings -- the mask was mounted in a position corresponding to the gunner's head.

The firings showed that the M19A1 Antiflash Mask did provide adequate protection against 3.5 Inch Rocket blowback. The M19 Antiflash Mask, tested in the first series for comparison purposes, was badly damaged.

Study of the new (M19A1) mask indicated need for human engineering.

UNCLASSIFIED

1. Protective clothing.

I. Huselton, Elbert
II. Schindler, Paul
III. Title: Mask, antiflash
IV. M19A1 Antiflash masks.
V. 3.5 Inch Rocket

UNITERMS

Mask
Antiflash
Rockets, 3.5 Inch
Launcher
M19A1
Huselton, E.
Schindler, P.

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Schindler, P.

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Dover, New Jersey

EVALUATION OF MASK, ANTIFLASH, ROCKET LAUNCHER, M19A1

Elbert Huselton, Paul Schindler

Technical Report DC-TR: 1-4-62, March 1962, 11 pp, photographs, tables.
Unclassified Report

Two series of 3.5 Inch Rocket firings at –20°F were run to observe the effect of rocket blowback on the M19A1 Antiflash Mask.

In the first series - - consisting of 20 firings - - the mask was mounted six inches aft of the launcher bell-mouth.

(over)

UNCLASSIFIED

1. Protective clothing

I. Huselton, Elbert
II. Schindler Paul
III. Title: Mask, Antiflash
IV. M19A1 Antiflash masks
V. 3.5 Inch Rocket

UNITERMS

Mask
Antiflash
Rockets, 3.5 Inch
Launcher
M19A1

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The firings showed that the M19A1 Antiflash Mask did provide adequate protection against 3.5 Inch Rocket blowback. The M19 Antiflash Mask, tested in the first series for comparison purposes, was badly damaged.

Study of the new (M19A1) mask indicated need for human engineering.

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